PB82-207796

Electrostatic Stimulation of Fabric Filtration

Research Triangle Inst.
Research Triangle Park, NC

Prepared for

Industrial Environmental Research Lab.
Research Triangle Park, NC

Oct 81

U.S. Department of Commerce
National Technical Information Service
NTIS

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before complet

1. REPORT NO. EPA-600/J-81-554	2. Journal Article	3. PB82-207796
4. TITLE AND SUBTITLE Electrostatic Stimulation of Fabric Filtration		5. REPORT DATE May 1982 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) G. Greiner and D. Furlong (ETS)/ D. VanOsdell (RTI)/ and L. Hovis (EPA/IERL-RTP)		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Research Triangle Institute P.O. Box 12194 Research Triangle Park, NC 27709		10. PROGRAM ELEMENT NO. 11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Journal article; 10/79-2/81 14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES Published in Journal of the Air Pollution Control Association, Volume 31, No. 10, pages 1125-1130,)October 1981.

16. ABSTRACT

The paper gives results of an investigation of the concept of electrostatic stimulation of fabric filtration (ESFF) at pilot scale. The pilot unit consisted of a conventional baghouse in parallel with an ESFF baghouse, allowing direct comparison. Reported results are for pulse-cleaned bags in which the electric field was maintained parallel to the fabric surface. The performance of the ESFF baghouse was superior to the parallel conventional baghouse by several measures. The ESFF baghouse demonstrated: (1) a reduced rate of pressure drop increase during a filtration cycle, (2) lower residual pressure drop, (3) stable operation at higher face velocities, and (4) improved particle removal efficiency. These benefits can be obtained with only minor modifications to conventional pulse-jet hardware and at low electrical power consumption. The indicated ability to operate at increased face velocities with only modest expenditure for electrical hardware leads to very favorable economic projections.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution Electrostatics Filters Fabrics Dust Filters Dust Flue Gases Coal	Pollution Control Stationary Sources Fabric Filters Baghouses	13B 21B 20C 21D 14G 11E 13K 11G

18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS (This Report) Unclassified 20 SECURITY CLASS (This page) Unclassified	21. NO. OF PAGES 8 22. PRICE

EPA Form 2220-1 (9-73)

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA 22161

CONTROL TECHNOLOGY News

OCTOBER 1981

EPA-600/J-81-554
Journal Article

Electrostatic Stimulation of Fabric Filtration

G. P. Greiner, D. A. Furlong
ETS, Inc.
Roanoke, Virginia

D. W. VanOsdell
Research Triangle Institute
Research Triangle Park, North Carolina

L. S. Hovis
U.S. Environmental Protection Agency
Research Triangle Park, North Carolina

The concept of electrostatic stimulation of fabric filtration (ESFF) has been investigated at pilot scale. The pilot unit consisted of a conventional baghouse in parallel with an ESFF baghouse, allowing direct comparison. All results reported in this paper are for pulse-cleaned bags in which the electric field was maintained parallel to the fabric surface. The performance of the ESFF baghouse has been superior to the parallel conventional baghouse by several measures. The ESFF baghouse demonstrated: (1) a reduced rate of pressure drop increase during a filtration cycle, (2) lower residual pressure drop, (3) stable operation at higher face velocities, and (4) improved particle removal efficiency. These benefits can be obtained with only minor modifications to conventional pulse-jet hardware and at low electrical power consumption. The indicated ability to operate at increased face velocities with only modest expenditure for electrical hardware leads to very favorable economic projections.

During the 68th Annual Meeting of the APCA in Boston, MA, in June of 1975, a paper by Lamb, Costanza, and Miller was given that laid the groundwork for our current pilot scale evaluation of *Electrical Stimulation of Fabric Filtration* (ESFF). At Textile Research Institute (TRI), researchers determined that fabric filter collection efficiency was greatly increased when an electric field was placed perpendicular to the gas flow or parallel to the fabric. They also postulated that other benefits might also be obtained such as "lower energy consumption, better bag cleaning, reduction in blinding and improved capture in the respirable range."[1] Since 1975, TRI has demonstrated the potential for these benefits under laboratory conditions.

A team composed of Research Triangle Institute (RTI), ETS, Inc. and TRI, under contract to the U.S. EPA, is evaluating this concept under pilot scale conditions.[2] RTI as prime contractor, has directed the technical effort and performed initial electrical hardware development and construction. ETS, Inc. has designed, built, installed, is operating the pilot unit, and is further developing the ESFF hardware. The pilot plant is installed on a slipstream of a pulverized coal boiler at the E. I. DuPont de Nemours & Company plant, Waynesboro, VA.

The program was started in October 1979. The primary objective during the first year was to verify the TRI laboratory results under actual flue gas conditions. The pilot unit was designed to operate in either pulse jet (outside collection) or traditional reverse air (inside collection) cleaning modes. Since the initial TRI work has all been with pulse jet, its evaluation was performed first and continued until February 1981. Excellent correlation with the TRI results was obtained and all the above postulated potential benefits appear to be real.

At the time of this writing, the pilot plant is being converted to reverse air cleaning. All results in this paper will be for pulse jet cleaning.

The Theory

What one tries to do with fabric filtration is to capture all the dust particles in a gas stream on the upstream surface of the fabric or formed dust cake and then periodically clean off most of the dust cake to reduce pressure drop. When felt fabrics are used, two problems occur. One, particles find their way directly through open fabric pores or get caught in the interstices of the fabric and become dislodged to the clean side during the cleaning cycle when the fabric snaps back on the cage. Two, fine particles penetrate to the scrim area of the fabric before collection and become permanently lodged, causing partial blinding of the fabric and higher pressure drop.

It is felt that the application of a high electrical field (≥ 2 kV/cm), perpendicular to the gas stream, imparts sufficient electrical force on the particles to remove them from the stream lines earlier and allow them to be collected farther upstream in the fabric. It has been shown that the level of the ESFF effect is improved by using a felt that has had its up-

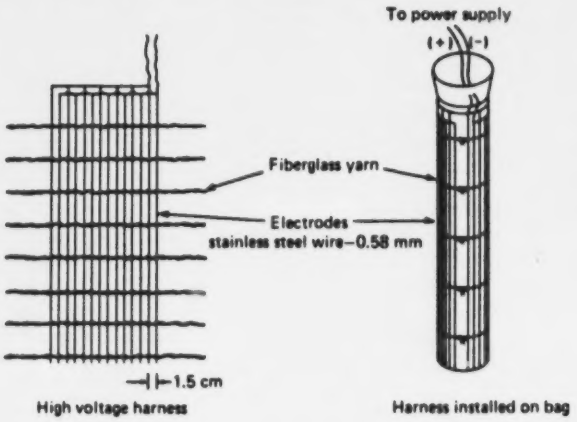


Figure 1. TRI harness.

stream surface napped, thus giving it a lower outside surface density and setting up collection sites farther from the interstices of the fabric.

Based on this theory, one would expect the napped felt fabrics to perform better than the smoother woven fabrics. They did during our evaluation.

The TRI Program

The TRI concept of ESFF consisted of applying an electric field parallel to the surface of the fabric through use of an electrode harness wrapped around the outside of the bag. The electrode wires were on the dirty side of the filter, in contact with, but not incorporated into the fabric.

Figure 1 is a schematic of the TRI "harness," which was developed over the course of the TRI work and used at bench scale to evaluate the ESFF effect. As shown, the harness was tied to the outside of the bag and electrically connected so that alternate electrode wires were at high electrical potential. An important practical aspect of this design is that the cage within the filter bag must be insulated to prevent electrical shorting through the fabric. In general, the TRI investigation was carried out at ambient temperature with the bag operating at low pressure drops (about 0.25 kPa, 1 in. W.G.). The dust was resuspended fly ash, with the bench pulse-jet unit cleaning on a 15-min cycle.

The major advantages found for the ESFF during the TRI investigation were a reduced rate of pressure drop increase and reduced particle penetration.

To define and compare the effect on pressure drop rise, a figure of merit called PDR (Pressure Drop Ratio) was developed. It looks at the beginning and ending ΔP across one cleaning cycle and compares the ΔP change with a field to that without; all other conditions being the same. PDR is defined as:

$$\text{PDR} = \frac{(\Delta P_f - \Delta P_r)\ \text{ESFF}}{(\Delta P_f - \Delta P_r)\ \text{Control}}$$

where ΔP is the pressure drop across the bags,
f refers to the final state (just prior to cleaning),
r refers to the residual state (just after cleaning),
and control refers to a baghouse without electrical enhancement.

For an idealized filter cycle in which the bag pressure drop increases linearly with time at constant dust loading from ΔP_r to ΔP_f, it can be shown that:

$$\text{PDR} = \frac{(K_2)\ \text{ESFF}}{(K_2)\ \text{Control}}$$

where K_2 is the specific cake resistance. PDR, then, is the ratio of the flow resistance of a dust cake collected by an ESFF system to that of a conventional fabric filter.

The Pilot System

The pilot system was designed to operate in either pulse jet or reverse air modes (with minor conversion). It provides the capability of simultaneous monitoring of the ESFF effect through use of two identical baghouses receiving their input from a common slipstream. One baghouse is supplemented with electrical enhancement, the other is not.

The system, with the capability of running at gas-to-cloth ratios (G/C) from 2–10:1, is outfitted to monitor and record pressure drop and temperature, monitor electric field strength, and allow testing of mass and particle size efficiency.

Figure 2 shows the system schematic. Each baghouse can accept up to 13 pulse cleaned bags, 11.7 cm (4-⅝ in.) in diameter and 224 cm (8 ft) long, or 9 reverse air bags 20 cm (8 in.) in diameter and 224 cm (8 ft) long. Construction is carbon steel throughout. Three inches of insulation with aluminum lagging was used on both the baghouses and all ductwork. The pilot units are fairly typical of the smallest industrial pulse jet collectors, except that access doors were aded to three sides for inspection, observation, and maintenance; and a special tube sheet was designed to accommodate experimental needs. Additional baghouse insulation, wall heaters, and improved door seals were added during the checkout period to correct a low temperature problem. Otherwise, the baghouses performed as designed.

It is felt that the use of parallel control and experimental units has made the difference between success and failure for the ESFF program. Due to varying inlet conditions, it would not have been possible to speak with confidence about the experiment if it had been operated serially.

The pilot unit was installed on a slipstream from an industrial boiler baghouse. Four pulverized coal boilers are in use with a normal load of about 160,000 kg/h (350,000 lb/h) of steam. The coal fed to the boilers changes frequently, with sulfur content varying from less than 1% to about 2%, and ash content ranging from 5 to 15%. The boilers are sometimes co-fired with oil. Inlet dust loadings at the pilot plant have varied from 0.6 to 5 g/scm (0.25 to 2 gr/scf); 0.7 g/scm (0.3 gr/scf) is typical.

High Voltage Electrical Hardware

The power requirements of the ESFF system are very low. The power consumption measured by TRI and confirmed in the pilot system is about 1 W/m² (0.1 W/ft²) of cloth. To see

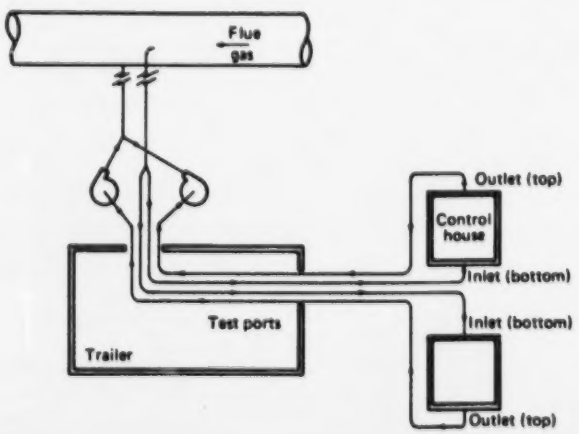


Figure 2. System schematic.

how little this really is, consider that at 6:1 G/C ratio, 1 in. W.G. of pressure drop costs about 10 W/m² (1 W/ft²) of cloth. In other words, the required ESFF power requirement is equal to approx. 0.1 in. ΔP at 6:1 G/C.

The electrical system used at the pilot unit consisted of a variable DC power supply (0 to 20 kV at 5 mA) for each of five power supply networks. Voltage was the controlled variable. Current and primary voltage were measured separately in each network. Current limiting and meter protection circuits were also used.

As described earlier, the TRI electrode harness consists of an array of small (0.016 in.) diameter vertical wires glued to horizontal yarns. The entire assembly was tied to the outside of the bag. Several problems were inherent in this design. The harness had the potential of restricting bag cleaning, was relatively fragile and difficult to install, presented materials

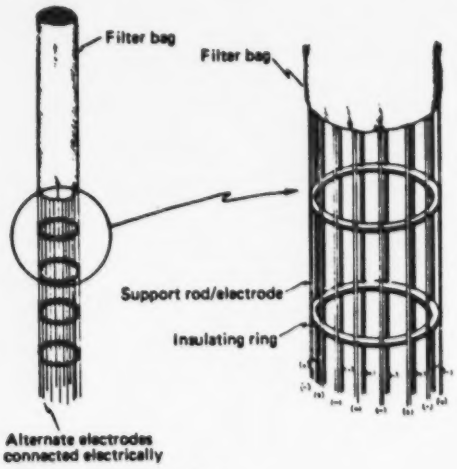


Figure 3. Inside electrodes.

problems in the high temperature flue gas environment, and required an insulated cage. In spite of these anticipated difficulties, to verify the laboratory data, harnesses constructed for the pilot unit were used to collect a significant portion of the data. From the standpoint of operating a research pilot plant, the failures of the insulating coating on the cages and of the harness adhesive were the most significant problems. The materials used deteriorated within 1 to 2 months and required frequent attention.

The problems discussed above were largely overcome with the design and construction of a new electrode assembly. The electrodes were moved to the clean side of the bag and performed the dual function of cage and electrodes (Figure 3). Early laboratory data taken by TRI indicated that performance with this electrode arrangement would be reduced from that possible with the outside harness. Pilot plant results for the two designs have been essentially identical, however. The inside electrodes were used successfully for several months. The Teflon insulation did wear thin and break down periodically, however, improved cage hardware is being developed at this writing.

Pilot Unit Operation

Pilot Unit Checkout. The initial portion of the pilot unit test program was intended to demonstrate the crucial point that the two baghouses really were parallel units with identical inlets. To accomplish this, both houses were operated as standard fabric filters.

Extensive calibration and testing of both houses was performed to ensure that both collectors were indeed seeing the same inlet conditions, baghouse temperatures, and in-leakage. Inlet and outlet orifices allowed minute-to-minute manual flow control but pitot tube measurements were used to verify gas flow for each test period. Mass loading was checked by both inlet gas stream testing and monitoring hopper discharge. The most convincing data were the identical ΔP traces of both baghouses captured by the strip charts over many days of operation.

Bag Conditioning. After the collection of enough data to ensure confidence that the two baghouses were comparable, the test bags were installed. The initial test bags were sewn from 23 oz Teflon felt that had been mechanically napped for a reduced surface density. Four bags were installed in each baghouse; electrical harnesses were installed on the bags in the ESFF baghouse. The bags were broken in at face velocity of 1 cm/sec (2 fpm). Once the temperature was above 80° C, the ESFF voltage was turned on at 4 kV/cm. The baghouses were kept at 1 cm/sec face velocity until the pressure drop reached 0.25 kPa (1 in. W.G.). Following the conditioning phase, the face velocity was raised to 3 cm/sec (6 fpm) and the test program was initiated.

Test Program

The test plan consisted of evaluating three types of fabrics, over a range of gas velocities with various levels of applied electrical field.

The rate of pressure drop rise, residual pressure drop, and collection efficiencies were monitored.

The fabrics tested were DuPont's 23 oz Teflon felt, mechanically napped, an experimental 17 oz Teflon felt needled to only one side of the scrim, and J. P. Stevens 17 oz woven fiberglass with 10% Teflon B finish, bulked in the fill yarn.

The filtering velocity was varied between 1 and 5 cm/sec (2–10 fpm). The field strength was varied from 0 to 5 kV/cm. Both the TRI harness and the clean-side cage/electrode described earlier were used to produce the electric field.

Normal operating procedure was to conduct the test program during the day and to leave the baghouse on automatic operation overnight and on weekends.

Results and Observations—Pulse Jet

General Observations

Visually, there were some differences between the dust cake of an ESFF bag and that of a conventional bag:

1. The thickness of the dust cake appeared to be less in the immediate vicinity of all electrodes for both inside and outside electrode configurations.
2. Some electrode configurations affected the thoroughness of bag cleaning either by restricting bag movement or attenuating the cleaning pulse.

Although it was not apparent visually, the collected dust from the ESFF house was consistently less dense when measured.

Since this ESFF effect is a result of a strong electric field, one would expect the effect to diminish as the cake depth builds to the regions of lower field strength. There was some evidence of this with extremely extended cleaning cycles. In general, the ESFF effect tended to be greater with a cleaner bag, however, cake thickness several times the electrode diameter still exhibited good PDR values.

Normal "good" operation of the ESFF baghouse required a current of only 1–20 μA at 8–10 kV/bag. It was clear that operation was affected by dust characteristics. Certainly, operation below the dew point was not possible because of excessive dust conductivity. Several times, usually during the night, the ESFF effect was intermittently diminished as evidenced by higher ΔP level and rate of rise on the strip recorders. Whether this was due to abnormal boiler conditions or electrode problems was never established. Except in cases

of extreme electrode insulator deterioration, the system corrected itself and returned to normal ΔP levels.

Rate of Pressure Drop Rise

As stated above, a primary purpose of this study was to confirm the bench results of TRI. Extensive testing was done to determine PDR values vs. field strength. Figure 4 shows typical pilot results as compared to the TRI curve for both Teflon and glass bags. No significant differences were seen between the two types of Teflons tested. The Teflon bag results were similar to the TRI curve but somewhat flatter. A definite PDR vs. field strength relationship was verified. PDR was not a function of G/C ratio.

The fiberglass bags, which do not have the low density surface characteristic of the Teflon bags, did not exhibit as great an ESFF effect. Only limited testing was accomplished; additional evaluation seems in order.

Figure 5 indicates some subtleties of the PDR evaluation and an additional difference in the ΔP rise created by ESFF. First, the traditional, nonlinear cake repair period shown, occurring within the first 10 min following cleaning of the control bags, did not occur with the ESFF bags in early testing. Even after several hundred hours of on-stream time, the ESFF bags had a substantially smaller cake repair effect.

This phenomenon made PDR values time-dependent as indicated by 0.2 at 10 min and 0.52 after 60 min. TRI established 15 min as the time scale for PDR and much of the testing was done with 15 min cleaning cycles.

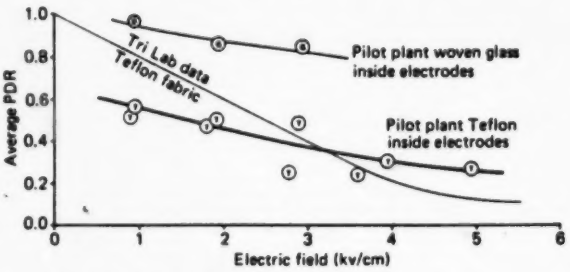


Figure 4. PDR vs. field strength.

Residual Pressure Drop

Figure 5 exhibits another key ESFF effect, lower residual pressure drop following a cleaning cycle. The ESFF ran 20 to 50% of the ΔP_R of the conventional baghouse. At higher G/C ratios and higher average differential pressure drops, this effect was significant reaching 1–2 KPa (4–8 in. W.G.).

Stability at Increased Face Velocity

Figure 6 shows a comparison of the residual or initial bag pressure drop at two filtering velocities. At 2.5 cm/sec (5 fpm) stable operation was present in both units. The difference in residual ΔP is clearly evident. At 4 cm/sec (8 fpm), only the ESFF unit continued stable. The ΔP of the conventional house had run away and was restricting gas flow. Note that the residual ΔP of the ESFF house at 4 cm/sec is still lower than the ΔP of the conventional house operating at 2.5 cm/sec. As will be discussed later, it is this effect that most promises economic rewards for ESFF.

Particle Collection Efficiency

No significant difference in overall mass efficiency was found between ESFF and control baghouses as determined

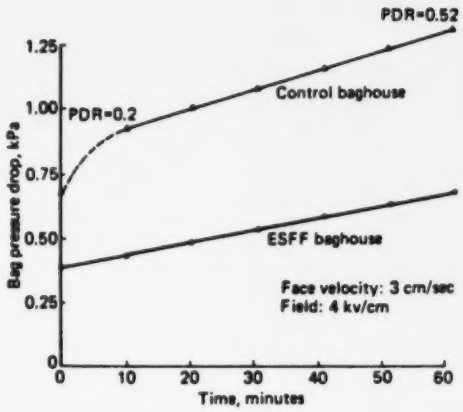


Figure 5. P vs. time from cleaning.

by several EPA Method 5 tests. Fractional efficiency tests, as determined by multiple cascade impactors, did show order of magnitude better collection over the range of 0.4–6.0 μm. Additional testing is needed to confirm these results; the units were set to clean automatically by ΔP during these tests and the conventional baghouse received more frequent cleaning. The indicated difference may then be due to seepage rather than initial collection efficiency. However, if an ESFF system actually requires less frequent cleaning as a result of lower PDR and ΔP_R, then the results are valid and important. One additional observation was that the ESFF efficiency was greatly reduced from 97–99% to 75% if the field was removed during testing of single-sided Teflon felt bags. This may be another confirmation that particle collection in the presence of the drift field is primarily occurring in the upstream regions of the fabric, leaving the inner fabric in a virgin state, subject to high penetration as for brand new fabric.

Economics

An analysis was performed to assess the economic potential of ESFF and to direct ongoing experiments toward parameters having economic advantage.

Pilot unit experience to date has been primarily with pulse-jet cleaned Teflon felt bags. A bag cost of \$9.50/ft^2 and a life of 4 years was chosen as reasonable for this type of operation. A conventional pulse jet baghouse for a coal-fired boiler typically operates at a fabric ΔP of 6 in. W.G. with a 4:1 G/C ratio. Extended operation at the pilot unit gave evidence that an ESFF baghouse can be expected to operate at a fabric ΔP of 2 in. W.G. at a G/C ratio of 4:1. Operation at ratios as high as 8:1 has been shown to be possible.

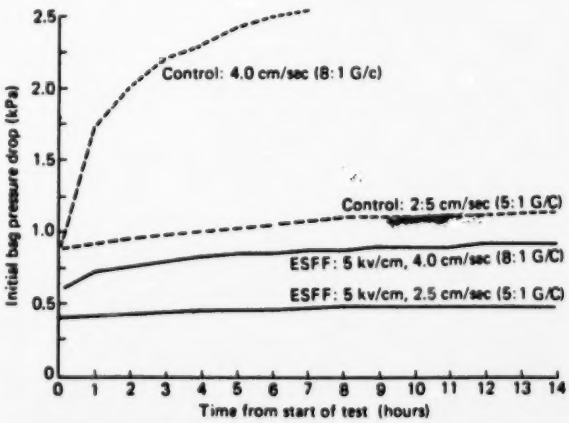


Figure 6. High gas/cloth ratio performance.

Figure 7 shows the potential savings associated with the ESFF concept. At G/C of 4:1 and $0.05/kWh, the ESFF baghouse has no advantage due to its higher capital cost. The ESFF annual cost does become less than the conventional baghouse at 4:1 as electrical costs increase. Significant annual cost savings are achieved by the ESFF concept as the G/C ratio is increased. Even if operation of 8:1 over the life of the baghouse is considered too optimistic, operation at 6:1 will save nearly $40,000 annually for $0.05/kWh electricity or nearly 30% of the total annualized cost of control. This analysis shows that, under the assumptions made, operation at high G/C ratios results in reduced annual costs. It is recognized that effects not described by the assumed equations (e.g., long term blinding of the fabric) currently restrict G/C ratios; however, it is these effects that ESFF apparently minimizes.

Early testing indicates that the ESFF effect reduced the long term buildup of dust in the fabric that is not removed by the normal cleaning cycle. This suggests that the ESFF baghouse can be expected to operate at a high G/C without long-term blinding. Reducing the fabric ΔP by a factor of 3 was found to have a greater benefit than increasing the bag life by a factor of 3 or reducing the bag cost by a factor of 10.

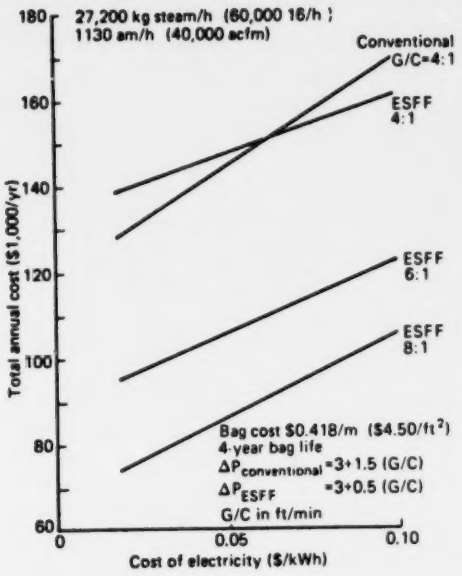


Figure 7. Pulse jet economics.

Reverse-Air Baghouse

The use of ESFF in reverse-air cleaning has not yet been tested at pilot scale. Bench work at TRI was somewhat successful. The woven glass fabrics normally used do not have favorable surface characteristics, although they do exhibit an ESFF effect.

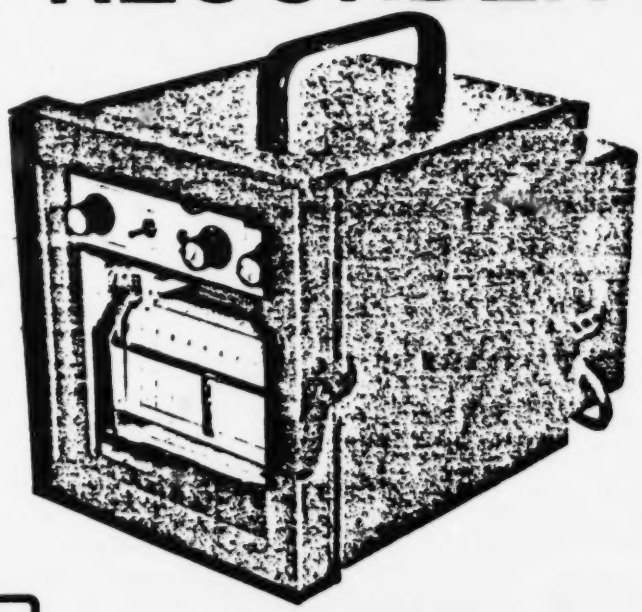
The pilot system is presently being converted to reverse air. Testing will begin in early April. Tests will begin with an electrode/cage design similar to that developed for the pulse jet but located on the outside (clean side) of the bag. If this is not satisfactory for the reverse-air mode, fabric/electrode combinations optimal for ESFF will be developed further.

If reverse air ESFF shows the same resistance to fabric blinding that has been evident with the pulse jet unit, opera-

BATTERY RECORDER

Operates on 115 VAC, 12 VDC or its own "piggy back" battery pack.

- Full 4" wide chart grid; Fanfold paper
- Reliable fiber tip cartridge pens
- 12 ranges from 1 millivolt to 100 volts
- 12 chart speeds from ½"/hr. to 10"/min.
- ½% accuracy, true servo system
- Rugged case with gasketed door
- "Piggy back" battery pack snaps on without tools for easy in-the-field replacement
- Battery life up to a week at slow speeds



MOLYTEK
STRIP CHART RECORDERS

2419 SMALLMAN STREET
PITTSBURGH, PA 15222 U.S.A.
(412) 261-9030

CIRCLE 17 ON READER SERVICE CARD

tion at increased G/C ratios will be possible and considerable savings will result.

A reverse-air cleaned baghouse for a new 100 MW power plant was analyzed using an installed capital cost of $24.00/ft of cloth, a G/C of 2.0, and a ΔP of 5 in. W.G. for the conventional baghouse. This resulted in a total annual cost for the conventional baghouse of $807,000/year for a bag life of 4 years. The analysis showed that $53,000 (7%) could be saved by an ESFF baghouse that would reduce the average ΔP to 2.5 in W.G. These savings would increase to $284,000 (35%)-/year if the ESFF baghouse further permitted the G/C to be increased to 3.0.

Conclusions

ESFF as developed in the laboratory has been transferred and improved successfully to a pilot scale unit on a coal-fired boiler flue gas. The ESFF baghouse can be operated at higher face velocities, at a lower residual pressure drop, and with a lower rate of pressure drop rise. This provides the potential for significant economic savings in total annual costs of control.

Acknowledgments

This work was supported by EPA Contract 68-02-3186 from the Industrial Environmental Research Laboratory, Research Triangle Park, North Carolina. The assistance provided by the E.I. DuPont de Nemours and Company, Inc. is gratefully acknowledged. The pilot unit was located in their Waynesboro, Virginia plant. Teflon® fabric was donated to the test program by DuPont.

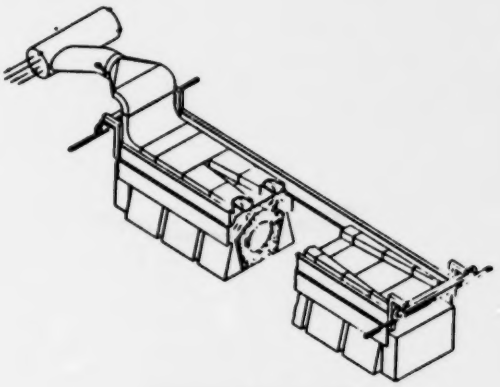
References

1. G. E. R. Lamb, P. A. Costanza, "A low-energy electrified filter system," *Filtration and Separation* 17: 319 (1980).
2. D. W. VanOsdell, G. P. Greiner, G. E. R. Lamb, L.S. Hovis, "Electrostatic Augmentation of Fabric Filtration," presented at Third EPA Symposium on the Transfer and Utilization of Particulate Control Technology, Orlando, FL, March 9–12, 1981.

Mr. Greiner and Mr. Furlong are with ETS, Inc., Suite C-103, 3140 Chaparral Drive, SW, Roanoke, VA 24018. Mr. VanOsdell is with the Research Triangle Institute, P.O. Box 12194, Research Triangle Park, NC 27709. Mr. Hovis is with the Industrial Environmental Research Laboratory (MD-61), U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.

Control Technology Newsbriefs . . .

Noll Associates Tennessee, Inc. (NAT) has developed a system which promises to provide effective control of particulate emissions from Acheson (electric) furnaces. A prototype hood has been utilized for several months in a major silicon carbide manufacturing plant. The total system for the same plant is expected to be operational in early 1982. Initial tests conducted by NAT indicated considerable variability in particulate emissions during different phases of lengthy (48 hours) furnacing cycles. Subsequent tests were conducted to determine an optimum number of moveable hoods for adequate control of multiple furnaces at reasonable cost.



ACHESON FURNACE HOOD

Good particulate control is achieved by using one hood for several furnaces. The hood is radio controlled and moves on tracks which facilitate relocation and permit crane access to the furnace for necessary manufacturing processes. Air distribution slots vent the furnace gases through an exhaust air plenum to a major duct which is connected to a baghouse. A break flange permits an easy means of meshing the hood with the ductwork. Side curtains of heat resistant material minimize the cost and weight of the hood and provide greatly improved control when the furnace sides are removed for the cooling process.

ETS, Inc., pollution control consultants, has successfully completed two of the three contracts awarded by Virginia Electric and Power Company (Vepco) to provide technical management for the refurbishment and optimization of performance of electrostatic precipitators. The work at the Vepco Possum Point, Virginia, Station-Units #3 & #4 was com-

AIR POLLUTION REMOTE SENSOR

The Barringer Research COSPEC® (correlation spectrometer) is a true remote sensor of SO_2 and NO_2 gases.

Quantitative measurements are made using ambient or artificial light.

Lower limit of detection 10 p.p.m.-metres or better in actual operations.

Applications include:

- vertical burden
- mass transport
- plume tracking
- source emission
- model verification

Over 75 users in 22 countries

For further information and reports including E.P.A. study contact **John H. Davies**

BARRINGER RESEARCH
304 Carlingview Drive
Rexdale, Ontario Canada M9W 5G2

CIRCLE 12 ON READER SERVICE CARD